Lat 40.44191 Lon -120.66438

Forest Health Protection

Pacific Southwest Region
Northeastern California Shared Service Area

Date: March 5, 2015
File Code: 3420

To: Joel Rathje, Lassen County Trail Coordinator

Subject: Forest Health Evaluation of Susanville Ranch Park (FHP Report NE15-04)

I conducted a two site visits of Susanville Ranch Park, next to the city of Susanville, on January 20 and March 4, 2015. The objectives of these visits were to evaluate the existing bark and woodboring beetle-caused tree mortality, assess current forest health conditions and to provide management recommendations as appropriate.

Key findings:

- Many ponderosa and Jeffrey pine stands are overstocked, putting them at risk to elevated levels of bark beetle-caused tree mortality, especially during periods of drought.
- Most acres contain heavy fuel loads consisting of live trees, tall brush, low brush, annual grasses and downed woody material.
- Bark and wood boring beetle-caused tree mortality is occurring at low levels with the exception of a large ~ 50 tree group kill of ponderosa and Jeffrey pines in the northeast corner of the park.
- Thinning and fuels reduction is highly recommended throughout Susanville Ranch Park to increase the health and vigor of residual trees and prevent stand replacing wildfire.

Description of the project area

Susanville Ranch Park is a 1,100-acre parcel owned by Lassen County next to Susanville, CA. Elevation for the site ranges from 4,400 to 5,700 feet and precipitation averages approximately 15-25 inches per year, increasing with elevation. The land is partially forested with openings that contain sagebrush (*Artemisia tridentata*) and bitterbrush (*Purshia tridentata*). Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*Pinus ponderosa*), western juniper (*Juniperus occidentalis*), black oak (*Quercus kelloggii*) and curlleaf mountain mahogany (*Cercocarpus ledifolius*) are all present within the forested areas. Jeffrey and ponderosa pine exist in a few high density stands but are mostly scattered, mixed with black oak and occasionally western juniper.

Danny Cluck
Forest Entomologist
530-252-6431
dcluck@fs.fed.us

Bill Woodruff
Plant Pathologist
530-252-6880
wwoodruff@fs.fed.us

Forest stand conditions

The majority of the acres at Susanville Ranch Park appear to be of low site quality for growing trees. This is mostly due to low annual precipitation, south facing slopes and poor soils in some locations. As a result, forested acres are mostly restricted to upper elevations that receive more precipitation or to drainages and flats at lower elevations that have deeper soil and better soil moisture conditions.

Ponderosa and Jeffrey pine are overstocked in some locations with density measurements above what is normally recommended to maintain low susceptibility to bark beetle attacks. For example, the mature ponderosa pine stand near the parking area on Piute Street currently contains an average of 136 sq.ft./acre of basal area (range 70 to 200) (Figure 1), the dense smaller diameter stands of mostly ponderosa pine located at the top of "Heart Attack" hill contain >200 sq.ft./acre (Figure 2) and denser ponderosa and Jeffrey pine groups further up the same drainage average >130 sq.ft./acre.

Figure 1. Dense stand of mature ponderosa pine next to the Piute Street parking area.

Figure 2. Dense stand of small diameter pines near the top of "Heart Attack" hill

Some ponderosa and most Jeffrey pines are growing under more open conditions, scattered among black oaks, western juniper and mountain mahogany. These pines may be less at risk to bark beetle attacks under normal precipitation conditions but are highly vulnerable to wildfire due to surrounding high fuel levels (both live and dead surface and ladder fuels).

Forest insect and disease conditions

Evidence of attack by California flatheaded borers (*Phaenops californica*) and pine engraver beetles (*Ips pini*) was found on recently killed large diameter ponderosa and Jeffrey pine growing in relatively open stands (Figure 3).

Figure 3. Ponderosa pine attacked by bark and woodboring beetles.

Figure 4. Jeffrey pine branch infected with western dwarf mistletoe.

Some small dense stands of Jeffrey pine are currently infected with western dwarf mistletoe (*Arceuthobium campylopodum*) (Figure 4). One of these was recently attacked by pine

engraver beetles, killing approximately 50 trees (Figure 5).

Bark beetles such as Jeffrey pine beetle (*Dendroctonus jeffreyi*) and western pine beetle (*Dendroctonus brevicomis*) were not observed at SRP during this site visit. However, these species have been recently observed causing Jeffrey and ponderosa pine mortality in the surrounding areas and have the potential to cause high levels of mortality at SRP under current conditions. There is also evidence of past mortality caused by western pine beetle in the dense stand near the Piute Street parking area.

*Forest insect and disease biology and ecology summaries are located in Appendix A.

Forest insect and disease susceptibility

Figure 5. Jeffrey and ponderosa pine killed by pine engraver beetles.

The forested areas at Susanville Ranch Park are highly variable as far as species mix, density and health. Better growing sites are holding higher numbers of ponderosa and Jeffrey pine while poorer sites contain more black oak with scattered western juniper. High stand density is increasing the susceptibility of ponderosa and Jeffrey pine to bark beetle attacks in some stands but most individuals are growing at lower densities among oaks and junipers at lower elevations and more eastern parts of SRP. The susceptibility of these more open grown pines to bark beetle attacks would generally be much lower than in dense stands. However, poor site quality increases these trees susceptibility to bark beetles and California flatheaded borers during drought conditions.

Western dwarf mistletoe infections appear to be isolated to small stands and individual trees. Heavily infected stands and trees are highly susceptible to drought and are often colonized by *Ips* bark beetles and California flatheaded borers. Dwarf mistletoe can spread from tree to tree in dense stands and often requires active management to control. At SRP, the wide spacing of pines in most dwarf mistletoe affected areas limits the amount and rate of spread.

Figure 6. Live and dead ladder fuels around a large ponderosa pine.

Black oaks are found in greater abundance than pine species in many locations but very little mortality is occurring due to competition. However, there is substantial dieback in the crowns of most trees, indicating frequent drought stress and subsequent attacks by oak bark beetles (*Psuedopityophthorus pubipennis*).

Although bark beetles have the potential to attack trees in the dense pine stands and woodborers may kill a few stressed trees during droughts, the potential for wildfire over the entire SRP is of greater concern. Live and dead surface fuels in most areas will likely facilitate rapid fire spread and ladder fuels will carry flames up into tree crowns. With the

current condition of dense and heavy fuels, stand replacing fire is the probable outcome under most fire weather conditions (Figures 6 and 7).

Considerations for thinning treatments

A variable thinning strategy was discussed for stands at Susanville Ranch Park. Variable thinning in pine stands should attempt to reduce basal area within the range of 60 – 100 sq.ft./acre. This flexibility in stocking will allow for the creation of gaps and clumps that mimic more natural conditions. However, thinning most stands to basal areas below 80 sq.ft./acre is highly recommended to free up soil moisture for residual trees and increase the longevity of treatments. This type of treatment should reduce susceptibility to bark beetle-caused mortality for most stands.

Figure 7. Pockets of dense trees and downed woody material can be found throughout SRP.

When pockets of western dwarf mistletoe infected pines are encountered, moderate to heavily infected trees should be removed, and especially overstory pines if they are close enough to infect healthy pine seedlings and saplings. Light infections in the lower crowns of trees may be pruned out when accessible.

Where they coexist, a mix of Jeffrey and ponderosa pine should be retained during any thinning treatment to maintain species diversity within the stand. Western juniper is the most drought tolerant species at SRP and should also be retained at low levels. Having a mix of species, including black oak, will increase forest resiliency to drought and bark beetles and ensure long-term forest cover.

Young black oaks that occur as multiple stemmed trees may benefit from the removal of some stems to promote faster tree growth. This treatment could promote the growth of larger trees that may be more resistant to fire if combined with ladder and surface fuel reduction, especially the pruning of dead limbs and low growing branches. Where black oak and ponderosa or Jeffrey pine crowns are intertwined it may be desirable to remove one species for the benefit of the other as pines will tend to shade out oaks and oaks may serve as fuel ladders to pine crowns in the event of a wildfire.

Considerations for *Ips* bark beetles

It is important when thinning pine stands to be aware of the potential for pine engraver beetle populations to increase in green slash. *Ips* populations can build up within green pine slash (>3" in diameter) in the spring and successfully attack and kill adjacent pines later in the summer. Mortality to residual pines from *Ips* beetle attacks in California have mostly been associated with green slash in the form of doodle piles or small hand piles that are left scattered throughout the stand in close proximity to residual trees. The risk of subsequent tree mortality increases with drier than normal conditions and when the green material is longer in length and/or is of a larger diameter that can prevent rapid drying.

Normally, doodles and/or hand piles created from mid-July through into fall (end of November) will not be conducive to significant *Ips* population build up. Also, based on past observations of pine engraver beetle activity on the eastside of the Sierra Nevada and Cascade mountain ranges, having pine slash, biomass and sawlogs consolidated into large piles at landings has not resulted in significant tree mortality,

regardless of timing. If thinning activities are to occur from late fall through early summer (December – Mid-July), any green pine material should be removed from the stand (can be consolidated onto landings), treated by chipping or burning or cut into short lengths, followed by stacking and covering with heavy clear plastic. Beetles will likely begin to infest green slash produced during this timeframe by late March/early April so it is best if this material can be treated before this date. Green slash produced between April and mid-July should be treated immediately. Avoid stacking green pine slash next to live pines as much as possible to avoid potential "slop over" attacks as beetles infest the cut material.

Considerations for fuels reduction treatments

While bark and woodboring beetles are likely to cause periodic tree mortality at SRP, the potential for stand replacing wildfire should be of much greater concern due to excessive surface and ladder fuels and the dryness of the site. It is highly recommended that fuels and fire specialists be consulted to conduct a more formal evaluation of current conditions and potential wildfire risks.

If you have any questions regarding this report and/or need additional information please contact Danny Cluck at 530-252-6431.

/s/ Danny Cluck

Daniel R. Cluck
Forest Entomologist
Forest Health Protection
Northeastern California Shared Service Area
530-252-6431
dcluck@fs.fed.us

cc:

Forest Health Protection, Regional Office

Western Pine Beetle

The western pine beetle, *Dendroctonus brevicomis*, has been intensively studied and has proven to be an important factor in the ecology and management of ponderosa pine throughout the range of this host species (Miller and Keen 1960). This insect breeds in the main bole of living ponderosa pine larger than about 8 inches dbh. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire. Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year.

Evidence of Attack

Initial attacks are made about mid-bole and subsequent attacks fill in above and below. Pitch tubes are formed on the tree trunk around the entry holes. The pitch tubes are red-brown masses of resin and boring dust. Relatively few, widely scattered, white pitch tubes usually indicate that the attacks were not successful and that the tree should survive. Pheromones released during a successful attack attract other western pine beetles. Attacking beetles may spill over into nearby apparently healthy trees and overwhelm them by sheer numbers.

Life Stages and Development

These beetles pass through the egg, larval, pupal and adult stages during a life-cycle that varies in length dependent primarily upon temperature. Adults bore a sinuous gallery pattern in the phloem and the female lays eggs in niches along the sides of the gallery. The larvae are small white grubs that first feed in the phloem and then mine into the middle bark where they complete most of their development. Bluestain fungi, introduced during successful attacks, contribute to the rapid tree mortality associated with bark beetle attacks.

Conditions Affecting Outbreaks

Outbreaks of western pine beetle have been observed, and surveys made, in pine regions of the West since 1899 (Hopkins 1899; cited in Miller and Keen 1960). An insect survey completed in 1917 in northern California indicated that over 25 million board feet of pine timber had been killed by bark beetles. Information from surveys initiated in the 1930s indicates that there were enormous losses attributed to western pine beetle around that time. During the 1930's outbreak, most of the mortality occurred in stands of mature or overmature trees of poor vigor (Miller and Keen 1960). Group kills do not typically continue to increase in size through successive beetle generations as is typical with Jeffrey pine beetle. Rather, observations indicate that emerging beetles tend to leave the group kill area to initiate new attacks elsewhere.

The availability of suitable host material is a key condition influencing western pine beetle outbreaks. In northeastern California, drought stress may be the key condition influencing outbreaks. When healthy trees undergo a sudden and severe moisture stress populations of western pine beetle are likely to increase. Healthy trees ordinarily produce abundant amounts of resin, which pitch out attacking beetles, but when deprived of moisture, stressed trees cannot produce sufficient resin flow to resist attack. Any condition that results in excessive demand for moisture, such as tree crowding, competing vegetation or protracted drought periods; or any condition that reduces that ability of the roots to supply water to the tree, such as mechanical damage, root disease, or soil compaction, can cause moisture stress and increase susceptibility to attack by the western pine beetle. Woodpeckers and predaceous beetles are natural control agents when beetle populations are low.

Jeffrey pine beetle

The Jeffrey pine beetle is the principle bark beetle found attacking Jeffrey pine, which is its only host. It is a native insect occurring from southwestern Oregon southward through California and western Nevada to northern Mexico. The beetle normally breeds in slow-growing, stressed trees. The beetles prefer trees which are large, mature, and occur singly rather than in groups. Yet when an epidemic occurs, the beetle may attack and kill groups of trees greater than 8 inches in diameter, regardless of age or vigor. Often the beetle infests lightning-struck or wind-thrown trees, but does not breed in slash.

Evidence of Attack

Presence of the beetle is usually detected when the foliage changes color. The color change of the foliage is related to the destruction of the cambium layer by the beetle. Generally, the top of the crown begins to fade in a slow sequence, with the needles turning from greenish yellow, to sorrel, and finally to reddish brown. By the time the tree is reddish brown, the beetles have usually abandoned the tree. Another sign of beetle attack is large, reddish pitch tubes projecting from the bark of the infested tree. If examined carefully, pitch tubes can be detected on infested green trees prior to crown fade. Jeffrey pine beetles have a distinctive "J" shape egg gallery pattern on the inner bark. Larval mines extend across the grain and end in open, oval-shaped pupal cells.

Life Stages and Development

The Jeffrey pine beetle is one of the larger pine bark beetles in California. The beetle has a 4 life stages, egg, larva, pupa, and adult. The adults are stout, cylindrical, black, and approximately five-sixteenths of an inch long when mature. The egg is oval and pearly-white. The larva is white, legless, and has a yellow head. The pupa is also white but is slightly smaller than the mature larva. The life cycle is normally completed in one year in the northern part of the range, but in the southern part, two generations per year may occur. The principle period of attack is in June and July, but attacks also are frequent in late September and early October. Similar to other *Dendroctonus* species, Jeffrey pine beetles use pheromones that attract other beetles to a tree, causing a mass attack that tends to overcome the tree's natural resistance. Blue stain fungi are associated with Jeffrey pine beetle attacks and aid in overcoming the tree’s defenses.

Conditions Affecting Outbreaks

Normally the Jeffrey pine beetle is kept in check by its natural enemies, climatic factors and the resistance of its host. Similar to other *Dendroctonus* species, the availability of suitable host material is a key factor influencing outbreaks. Healthy trees ordinarily produce abundant amounts of resin, which pitches out attacking beetles. When deprived of moisture, or stressed by other factors such as disease or fire injury, trees cannot produce sufficient resin flow and become susceptible to successful beetle attacks.

Dwarf mistletoe

Dwarf mistletoes (*Arceuthobium* spp.) are parasitic, flowering plants that can only survive on living conifers in the Pinaceae. They obtain most of their nutrients and all of their water and minerals from their hosts.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and fall from the aerial shoots. The seeds are forcibly discharged. The seed is covered with a sticky substance and adheres to whatever it contacts. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds travel after being discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long distance spread of dwarf mistletoe is occassionaly vectored by birds and animals.

Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density. Because of the thin crowns of gray pine, however, the vertical rate of spread has been measured as being greater than 2 feet per year. This rate of spread equalled or exceeded the rate of height growth of infected trees.

Dwarf mistletoes are easy to identify because they are generally exposed to view within a tree's crown. Signs of infection include the yellow-green to orange mistletoe plants, basal cups on a branch or stem where the plants were attached and detached plants on the ground beneath an infected tree. Symptoms include spindle-shaped branch swellings, witches' brooms in the lower crown, and bole swellings.

Ips **bark beetles**

Ips spp. attacks have been recorded on most species of pines in California. These beetles kill saplings, poles and sawtimber up to about 26 inches dbh and the tops of even larger trees. Attacks on live trees are usually limited to trees which are suppressed, or stressed by dwarf mistletoe, root disease, drought, fire or the attack of other insects. If fresh slash is available in the spring, pine engravers may build up in an area and cause localized mortality or top killing by mid-summer.

Attacks are made with the coming of warm weather in the spring. Attacking males bore nuptial chambers in the inner bark and release a pheromone which attracts other beetles to the attack site. If many beetles are attracted, they may attack nearby trees and cause a group kill. Within a day or two of the attack by the male, two to five females enter the nuptial chamber and after mating, each female bores an individual egg gallery which lightly scores the sapwood. The size and pattern of the combined gallery pattern is often diagnostic of the species of Ips involved. The galleries are kept open by beetles pushing boring dust out through the entrance hole. Red boring dust collecting in bark crevices or spider webs is diagnostic of a successful attack. Eggs are laid in niches along the sides of the galleries. Larvae hatch from the eggs and feed in the phloem. They eventually pupate in cells at the end of their larval mines and transform to adults.

A new generation is produced in as little as 6-8 weeks in the spring to 4-6 weeks in mid-summer (August). Thus, several overlapping generations per year may be produced. The winter may be passed in any of the life stages of larvae, pupae, or adults, depending upon which *Ips* species is involved.

Outbreaks in standing, healthy trees are sporadic and of short duration, and are often associated with some temporary stress or shock afflicting the host species, such as drought or logging disturbance. Tree killing frequently occurs where green pine slash, which serves as breeding habitat is left untreated during spring and summer. To be suitable as *Ips* breeding habitat, pine slash must have bark from 1/8 to 1 inch thick (usually 3 to 26 inches diameter), must have succulent cambium and must remain moderately cool during the development period.

Fresh pine slash caused by thinning, dwarf mistletoe control work, construction or winter storm breakage can be modified in a number of ways to make it unsuitable for *Ips* breeding. One approach to minimizing damage is to schedule slash-generating activities mostly between mid-July and late-December, when the slash has a high probability of drying out, heating up, or spoiling before the beetles can complete their development. Utilization of the cut material to the smallest possible diameter will minimize the amount of breeding material available to *Ips* beetles. If green pine slash must be created during the spring and early summer, slash treatments are available to

prevent the buildup of pine engraver populations. Because *Ips* beetles can complete their development in about a month under ideal conditions, treatment should be carried out soon after cutting to be effective.

Slash treatment methods which generally work well include chipping, lopping and scattering slash in sunny areas to heat it up, crushing or mashing slash with logging equipment to make it unsuitable for *Ips* breeding, or piling and burning the slash within a month of cutting. Broadcast burning the slash might work if it could be done without damaging the residual stand. A method which has worked during the summer in hot climates is to pile slash in a sunny area and tightly cover the pile with clear plastic. If the temperature under the bark of slash in all parts of the pile reaches 120^{o}F, all brood currently in the pile will be killed. Lower temperatures will not be effective and, where successful, this method will not prevent reinfestation of slash piles. Because most *Ips* attacks occur within a quarter-mile from the location where the beetles emerged, high value pines can be given some protection by removing fresh pine slash to areas which do not have pines.

Two practices which should generally be avoided are piling fresh pine slash without further treatment, and allowing slash to touch or remain near valuable leave trees.